Michigan Department of Community Health
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Healthcare-associated Infections
HAI Elimination
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Surveillance & Infectious Disease Epidemiology

HEALTHCARE-ASSOCIATED INFECTIONS IN MICHIGAN HOSPITALS

Quarterly Report of Healthcare-Associated Infection Surveillance Activities

October 1, 2011–December 31, 2011

Michigan Department of Community Health

Surveillance for Healthcare-Associated & Resistant Pathogens (SHARP) Unit

Data Accessed: February 2, 2012

Introduction

The Surveillance for Healthcare-Associated & Resistant Pathogens (SHARP) Unit within the Bureau of Disease Control, Prevention, and Epidemiology at the Michigan Department of Community Health (MDCH) will provide a quarterly update on healthcare-associated infection (HAI) surveillance activities. This report will include Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network (NHSN) data from Michigan hospitals who have agreed to share their data with MDCH SHARP. The main surveillance foci for the SHARP Unit were originally methicillin-resistant *Staphylococcus aureus* (MRSA) and *Clostridium difficile* (*C. difficile* or *C. diff*) reports collected through the laboratory-identified (LabID) event option of the multidrug-resistant organism and *Clostridium difficile* infection (MDRO/CDI) module of NHSN. Additionally, we are actively reviewing device-associated data for CLABSIs, CAUTIs, and SSIs. Aggregated data will be used to show infection rates and trends in the incidence of specific HAIs and MDROs. Previous quarterly reports for 2009, 2010, and the first three quarters of 2011 are posted on the Michigan HAI website at www.michigan.gov/hai. As more Michigan hospitals agree to participate in this surveillance initiative, the information and data will become more reliable and complete from quarter to quarter.

Additional background information on HAIs, pertinent definitions related to HAIs, Michigan's HAI Surveillance and Prevention Plan, Michigan's HAI Prevention Advisory Group roster, and Michigan's prevention collaboratives can be found at www.michigan.gov/hai.

Acronyms Used in Quarterly Reports

ARRA	American Recovery and Reinvestment Act
CAUTI	Catheter-Associated Urinary Tract Infection
CDC	Centers for Disease Control & Prevention
CDI	*Clostridium difficile* Infection
CLABSI	Central Line-Associated Bloodstream Infection
DUA	Data Use Agreement
HAI	Healthcare-Associated Infection
ICU	Intensive Care Unit
LabID	Laboratory-Identified Event
MDCH	Michigan Department of Community Health
MDRO	Multidrug-Resistant Organism
MHA	Michigan Health & Hospital Association
MPRO	Michigan's Quality Improvement Organization
MRSA	Methicillin-Resistant *Staphylococcus aureus*
NHSN	National Healthcare Safety Network
SCA	Specialty Care Area
SHARP	Surveillance for Healthcare-Associated & Resistant Pathogens Unit
SSI	Surgical Site Infection
VAP	Ventilator-Associated Pneumonia

Surveillance Initiative Statistics

Between October 1 and December 31, 2011, a cumulative total of 54 Michigan hospitals voluntarily participated in the SHARP Unit HAI surveillance initiative, as demonstrated by signed data use agreements. Twenty-five of these hospitals used the LabID Event option of the MDRO/CDI module to monitor MRSA in their reporting plan; fourteen of the 25 shared this data with SHARP. Thirty-one monitored and 15 shared *C. difficile* LabID Events. Areas of surveillance within the hospital varied by participating hospital and included the intensive care/critical care unit (ICU/CCU), specialty care areas (SCA), medical/surgical wards, or other, dependent upon individual hospital choice. Data from this quarter, previous quarters in 2011, and the 2010-2011 Semi-Annual Report were used in this report to establish aggregate infection rates among participating Michigan hospitals and to monitor quarterly trends.

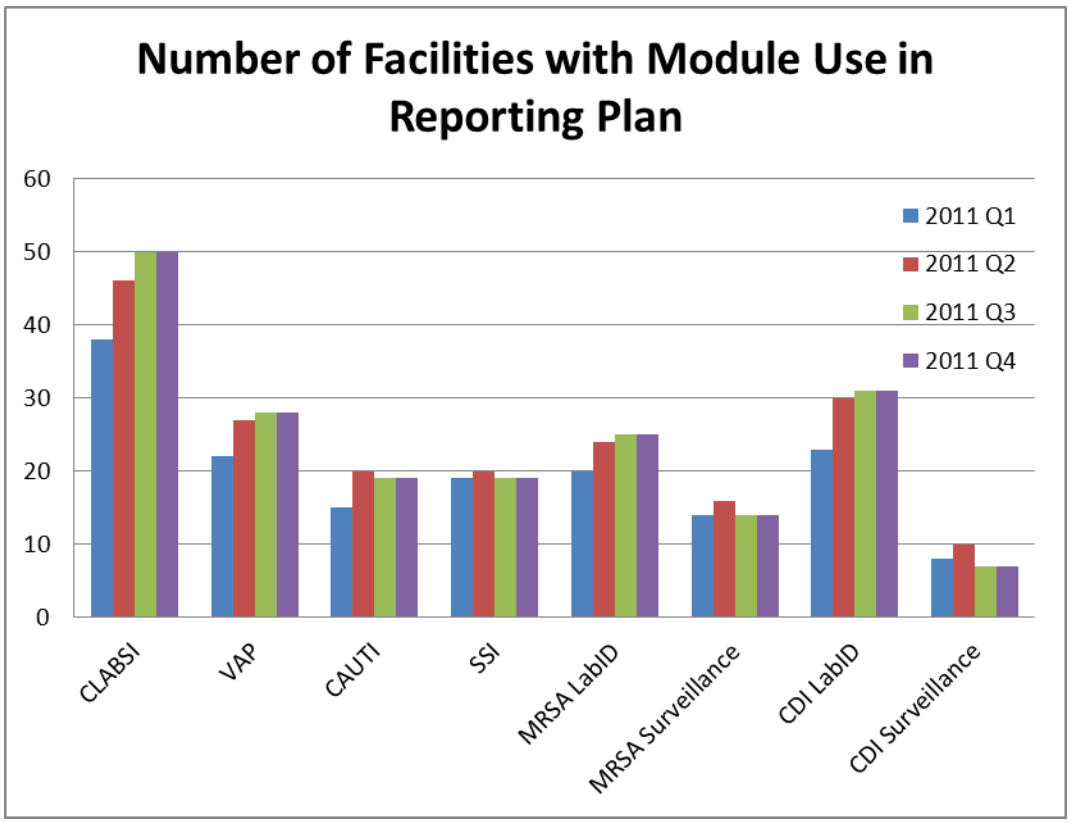
Of the 54 hospitals participating this quarter, most collected additional NHSN module data as indicated in Table 1. For example, 50 of the 54 hospitals utilized the CLABSI module; of these, 44 shared this data with the SHARP Unit. As more hospitals participate with the SHARP Unit and confer rights to these modules, analysis of the data will become more complete and reliable.

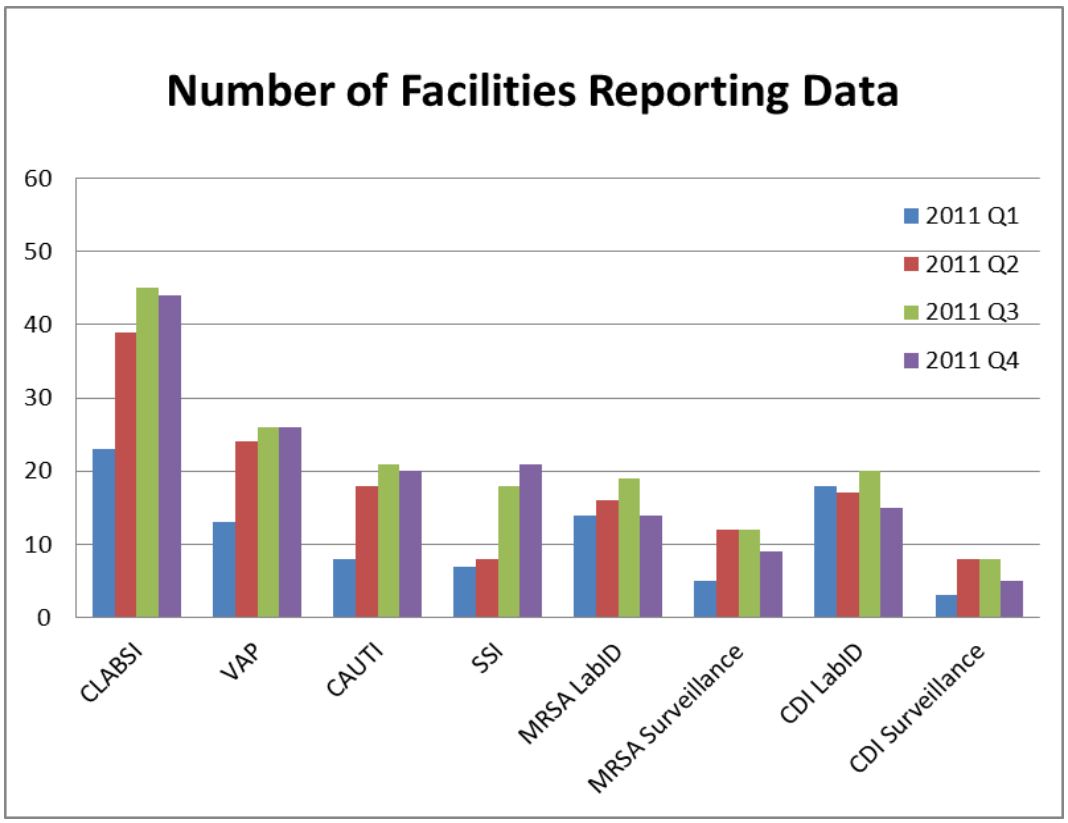
Table 1.

National Healthcare Safety Network (NHSN) Modules in Use, as Reported by Facility April 1, 2011 through June 30, 2011

NHSN Module	Number of Facilities Using Module[1]	Number (%) of Facilities Sharing Data[2]
Central Line-Associated Bloodstream Infection (CLABSI)	50	44 (88)
Clostridium difficile Infection (CDI) Laboratory-Identified (LabID) Event	31	15 (48)
Ventilator-Associated Pneumonia (VAP)	28	26 (93)
Methicillin-Resistant *Staphylococcus aureus* (MRSA) Laboratory-Identified (LabID) Event	25	14 (56)
Catheter-Associated Urinary Tract Infection (CAUTI)	19	20 (105)
Surgical Site Infection (SSI)	19	21* (111)
Methicillin-Resistant *Staphylococcus aureus* (MRSA) Infection Surveillance	14	9 (64)
Clostridium difficile Infection (CDI) Infection Surveillance	7	5 (71)

[1]Number of Facilities using each module out of those who have signed a DUA with SHARP as of 1/10/12
[2]Number of facilities sharing data for each module with SHARP as of 2/2/12. Some numbers in this column may be larger than the number of facilities using each module because this module may have been added to their respective reporting plan between 1/10/12 (the date the number of modules within each reporting plan were counted) and 2/2/12 (the date the data were pulled from NHSN).
*As of March 1, 2012


Number of Facilities with Module Use in Reporting Plan
60
50
40
30
20
10
0
2011 Q1
2011 Q2
2011 Q3
2011 Q4
CLABSI
VAP
CAUTI
SSI
MRSA LabID
MRSA Surveillance
CDI LabID
CDI Surveillance


Number of Facilities Reporting Data
60
50
40
30
20
10
0
2011 Q1
2011 Q2
2011 Q3
2011 Q4
CLABSI
VAP
CAUTI
SSI
MRSA LabID
MRSA Surveillance
CDI LabID
CDI Surveillance

Methicillin-Resistant Staphylococcus aureus (MRSA) Data

Table 2 (below) indicates that between October 1 and December 31, 2011, 371 isolates of MRSA were reported from sixteen participating hospitals using the MDRO/CDI module LabID Event option. The NHSN definition for MRSA LabID Event includes the first positive MRSA isolate from any specimen per calendar month per patient, or a positive MRSA isolate from a blood source when there haven't been any other positive blood specimens in ≤2 weeks from that patient. Specimens must be collected for clinical purposes and not for the purpose of active surveillance testing or screening. Additionally, testing protocol and type of test used (i.e. PCR, assay, culture) vary by facility. Note that data from the LabID Event option of the MDRO/CDI module are considered proxy measures of MRSA exposure burden, and do not distinguish between patient colonization and infection.

Table 2. **MRSA Characteristics**	**Semi-Annual Report October 2010-March 2011**	**April 1– June 30, 2011**	**July 1 – Sept. 30, 2011**	**October 1 – Dec. 31, 2011**
Frequency, Number				
Hospitals with DUA[1]	41	47	53	54
Hospitals Reporting MRSA LabID[2]	16	16	25	25
Aggregated MRSA LabID Events	897	415	613	371
Onset, Number (%)				
Healthcare Facility-Onset (HO)	234 (26)	84 (20)	114 (19)	86 (23)
Community-Onset (CO)	663 (74)	331 (80)	499 (81)	285 (77)
Previous MRSA, Number (%)				
Previously positive	Not Available	74 (18)	126 (21)	77 (21)
Specimen Source, Number (%HO)				
Blood	42 (33)	39 (15)	50 (18)	49 (14)
Sputum	115 (37)	102 (38)	96 (41)	84 (42)
Wound	261 (10)	146 (10)	263 (9)	91 (5)
Abscess	79 (3)	11 (9)	26 (4)	13 (0)
Urine	59 (8)	26 (12)	47 (4)	18 (22)
Skin	76 (1)	4 (25)	9 (0)	3 (0)
Other	98 (29)	87 (23)	122 (32)	113 (31)
Surveillance Location, Number (%)				
Intensive/Critical Care Unit	329 (37)	123 (30)	158 (26)	143 (39)
Specialty Care Area	-	-	-	-
Wards	432 (48)	228 (55)	278 (46)	192 (52)
Outpatient	136 (15)	64 (15)	177 (29)	36 (10)
Other	-	-	-	-

[1]*DUA:* Data Use Agreement signed on or before February 2, 2012
[2]*LabID:* Laboratory-Identified Event

Eighty-six (23%) MRSA LabID Events this quarter were determined to be healthcare facility-onset (HO), and the remainder (285, or 77%) were determined to be community-

onset (CO). NHSN defines 'healthcare facility-onset' as a 'LabID Event specimen collected >3 days after admission to the facility (i.e., on or after day 4).' 'Community-onset' is defined by NHSN as a 'LabID Event specimen collected as an outpatient or an inpatient ≤3 days after admission to the facility (i.e., days 1, 2, or 3 of admission).'

For this quarter, the percent of events which were healthcare facility-onset varied by specimen source. Sputum specimens had the largest proportion of healthcare facility-onset events (42%), closely followed by other specimen sources (31%). These were followed by urine (22%), blood (14%), wound (5%), and abscess and skin (both 0%). The majority of all MRSA LabID Event specimens were collected from patient wards (52%), followed by ICU/CCUs (39%) and outpatient locations (10%). Twenty-one percent of MRSA LabID Events occurred in patients for whom a MRSA LabID Event had been recorded in a prior month.

Clostridium difficile Infection (CDI) Data

Table 3. ***C. difficile* Characteristics**	**Semi-Annual Report October 2010-March 2011**	**April 1– June 30, 2011**	**July 1 – Sept. 30, 2011**	**October 1 – Dec. 31, 2011**
Frequency, Number				
Hospitals with DUA[1]	41	47	53	54
Hospitals Reporting CDI LabID[2]	22	22	31	31
Aggregated CDI LabID Events	455	290	358	291
Onset, Number (%)				
Healthcare Facility-Onset (HO)	184 (40)	119 (41)	125 (35)	87 (30)
Community-Onset Healthcare Facility-Assoc (CO-HA)	92(20)	70 (24)	94 (26)	45 (15)
Community-Onset (CO)	179 (39)	101 (35)	139 (39)	159 (55)
Previous CDI, Number (%)				
Previously positive	Not Available	38 (13)	36 (10)	36 (12)
CDI assay, recurrent	Not Available	24 (8)	25 (7)	19 (7)
Surveillance Location, Number (%)				
Intensive/Critical Care Unit	116 (25)	54 (19)	77 (22)	71 (24)
Specialty Care Area	9 (2)	3 (1)	8 (2)	5 (2)
Wards	309 (68)	208 (72)	205 (57)	159 (55)
Outpatient	21 (5)	25 (9)	67 (19)	59 (19)
Other	-	-	1 (0)	-

[1]*DUA:* Data Use Agreement signed on or before February 2, 2012
[2]*LabID:* Laboratory-Identified Event

As shown in Table 3 (above), this quarter there were 291 reports of CDIfrom 31 hospitals which used the MDRO/CDI LabID Event option in their reporting plan. The NHSN definition for CDI LabID Event includes the first positive *C. diff* test result without a prior

positive in ≤2 weeks. As with MRSA LabID Events, *C. difficile* LabID Event specimens must be collected for clinical purposes, not for the purpose of active surveillance testing or screening. Testing protocol and type of test used (i.e. PCR, assay, culture) may vary by facility. *C. difficile* LabID Event data are considered proxy measures of exposure burden, and do not distinguish between patient colonization and infection.

Eighty-seven, or 30%, of CDI LabID Events were considered healthcare-onset. Forty-five (15%) were considered community-onset healthcare facility-associated (COHA), and 159 (55%) were reported as community-onset. *Community-onset healthcare facility-associated* is defined as a 'community-onset LabID Event collected from a patient who was discharged from the facility ≤4 weeks prior to the date the stool specimen was collected.' (Healthcare facility-onset and community-onset are defined under the MRSA LabID Event data heading). Evaluating location of CDI LabID Event specimen collection, 159 (55%) were reported from patient wards, 71 (24%) from ICU/CCU, 59 (19%) from outpatient locations, and 5 (2%) from SCA. Twelve percent of CDI LabID Events occurred in patients who had a prior CDI LabID Event entered in a previous month. In addition, 7% of LabID Events were recurrent CDI assays. A recurrent CDI assay is a '*C. difficile* LabID Event specimen obtained greater than 2 weeks and less than or equal to 8 weeks after the most recent LabID Event for that patient.'

Multidrug-Resistant Organisms (MDRO) Summary Data

Table 4 (below) provides an overview of the rates of LabID and Infection Surveillance Events for multidrug-resistant organisms (MDROs). Data are shown for organisms where five or more facilities are conducting surveillance for that particular organism.

Table 4.

Quarterly Multidrug-Resistant Organism (MDRO) Rates

MDRO Organism	Number of Facilities	Number of Inpatient Events	Number of Patient Days	Number of Patient Admits	MDRO Rate[1]	MDRO Admission Prevalence Rate[2]
MRSA[3] LabID[4]	14	121	47,570	5,252	2.54	2.30
MRSA Infection[5]	9	1	15,227		0.07	
C. diff[6] LabID	15	102	75,337	15,947	13.54	0.64
C. diff Infection	5	3	7,001		4.29	

☐ Michigan Rate among facilities sharing data with SHARP

[1]MDRO Rate: The rate of MDRO LabID events or infections per 1,000 patient days (or encounters) for all organisms, except *C. difficile*, which is the number of CDI LabID Events or infections per 10,000 patient days.

[2]MDRO Admission Prevalence Rate. The number of MDRO LabID Events per 100 inpatients admitted.

[3]Methicillin-Resistant *Staphylococcus aureus* (MRSA)

[4]Lab ID: Laboratory-Identified (LabID) Event. This is an option within the Multidrug-Resistant Organism/ *Clostridium difficile* Infection (MDRO/CDI) Module of NHSN for tracking laboratory results without conducting additional surveillance for infections.

[5]Infection: MDRO event under infection surveillance. This is an option in the MDRO/CDI module for conducting infection surveillance.

[6]C. diff: *Clostridium difficile*

The MRSA LabID Event rate decreased significantly this quarter, from 4.45 to 2.54 per 1,000 patient days. The *C. diff* LabID Event rate decreased from 15.95 to 13.54 per 10,000 patient days. The MRSA infection surveillance rate decreased from 0.19 to 0.07 per 1,000. Neither of these rates was significantly different. The *C. diff* infection surveillance rate increased from 2.72 to 4.29 per 10,000 patient days, although this was not a statistically significant increase. The Admission Prevalence Rates for MRSA and *C. diff* LabID Events increased from 1.85 to 2.30 per 100 patients admitted and from 0.52 to 0.64 per 100 patients admitted, respectively. The MRSA Admission Prevalence Rate was significantly increased , while the *C. diff* increase was not significantly different.

Figures 1, 2, and 3 (below) detail the trends of the different MDRO module rates for the all four quarters of 2011.

Figure 1.

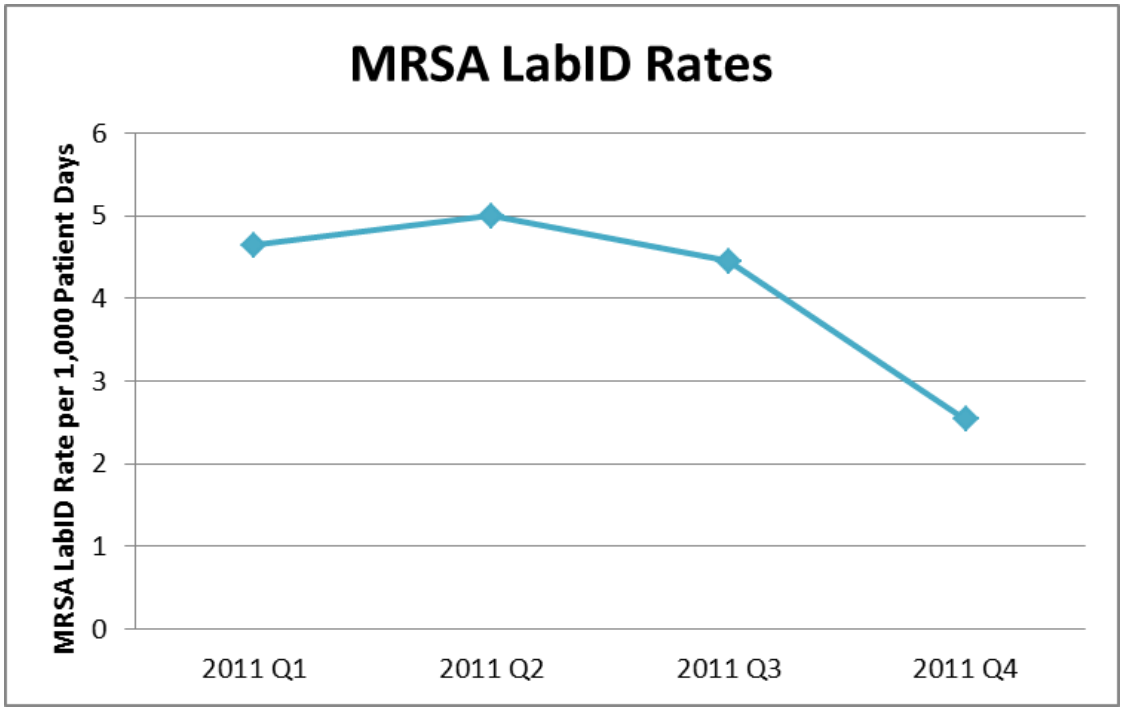


Figure 2.

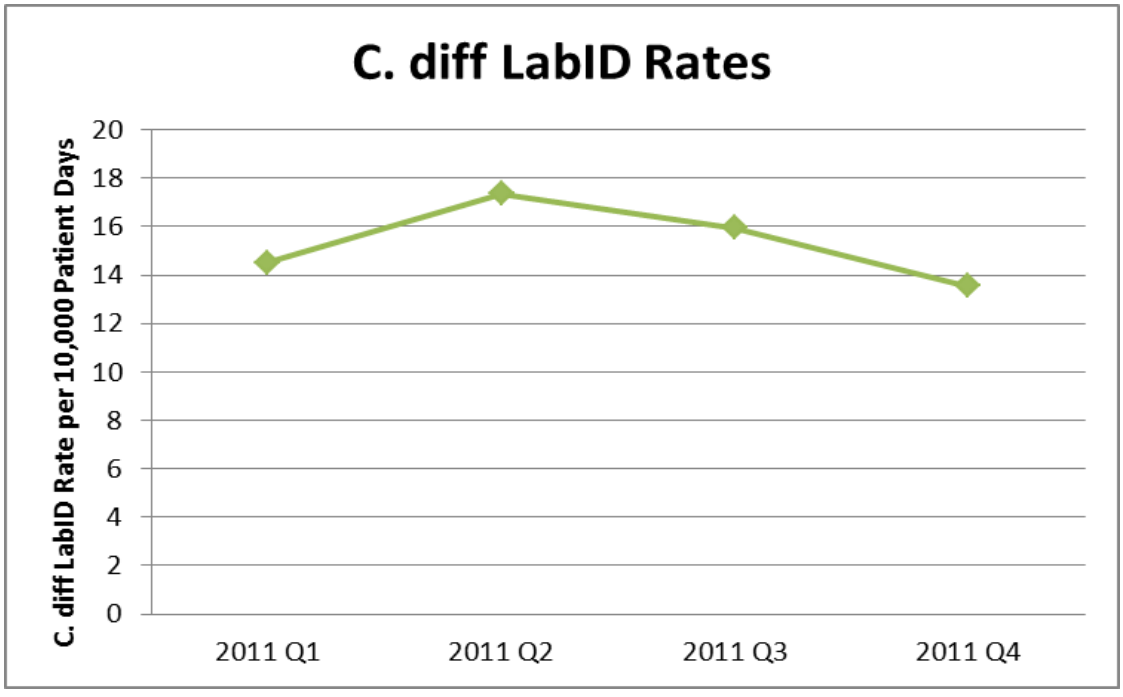
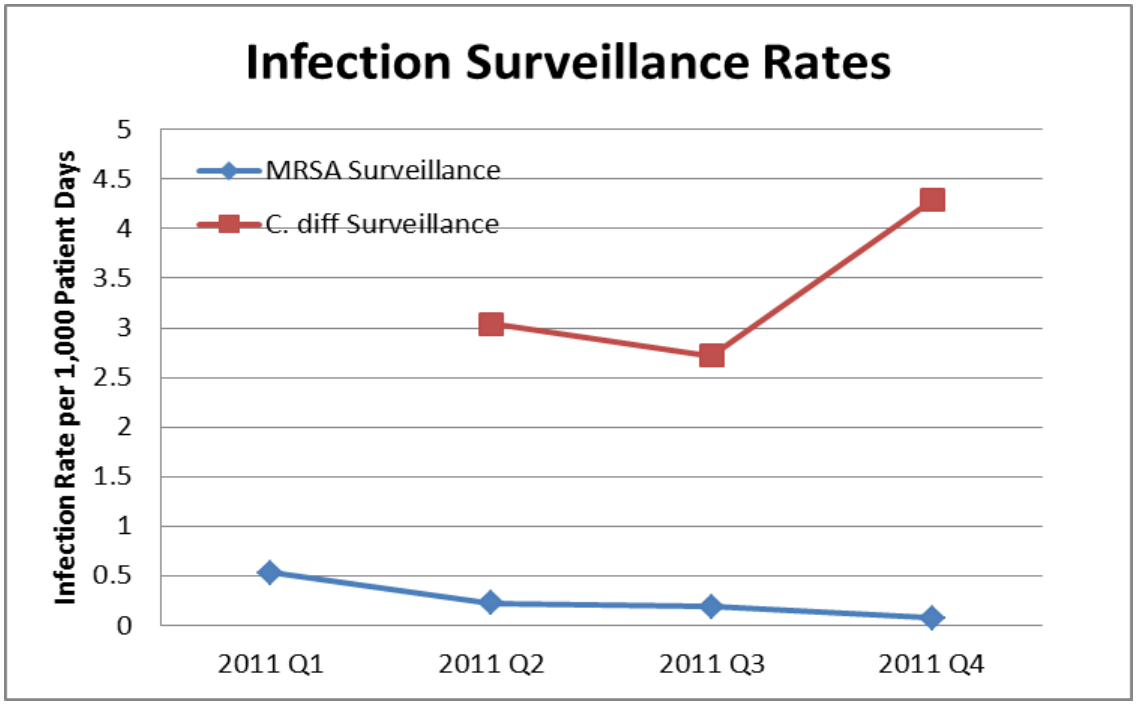


Figure 3



Device-Associated Summary Data

Table 5 (below) provides a summary of the Device-Associated Infection Rates as well as the Device Utilization (DU) Ratios for each device: urinary catheters, central lines, and ventilators. Data are shown for infections where five or more facilities collected and shared data for that particular infection. Although nineteen facilities are participating in the Catheter-Associated Urinary Tract Infection (CAUTI) module, 20 shared data with MDCH SHARP. This is most likely a result of facilities changing their reporting plan between when their module usage was counted (1/10/12) and when the data were actually pulled (2/2/12). Forty-four of the 50 facilities utilizing the Central Line-Associated Blood Stream Infection (CLABSI) module provided data to the SHARP Unit, and 26 of 28 facilities participating in the Ventilator-Associated Pneumonia (VAP) module also provided data.

Table 5.

Device-Associated Rates

Device-Associated Infection	Number of Facilities	Number of Infections	Number of Patient Days	Number of Device Days	MI Device-Associated Infection Rate[1]	US Device-Associated Infection Rate[2]	MI DU[3]	US DU
CAUTI[4]	20	26	91,162	24,408	1.07	1.71	0.27	0.26
CLABSI[5]	44	33	178,370	56,065	0.59	1.46	0.31	0.30
VAP[6]	26	9	50,924	17,003	0.53	1.82	0.33	0.32

Michigan Rate among facilities sharing data with SHARP Comparative National Rate

[1]MI Device-Associated Infection Rate: The number of infections per 1,000 device days among participating MI facilities.

[2]US comparative rates were calculated using a pooled mean from the national estimate on the National Healthcare Safety Network (NHSN). This estimate varies by unit type and with the proportion of device days reported in the unit.

[3]DU: Device Utilization Ratio. The proportion of patient days spent on a device divided by the total number of patient days reported for the unit. The device could be a catheter, central line, or ventilator.

[4]CAUTI: Catheter-Associated Urinary Tract Infection

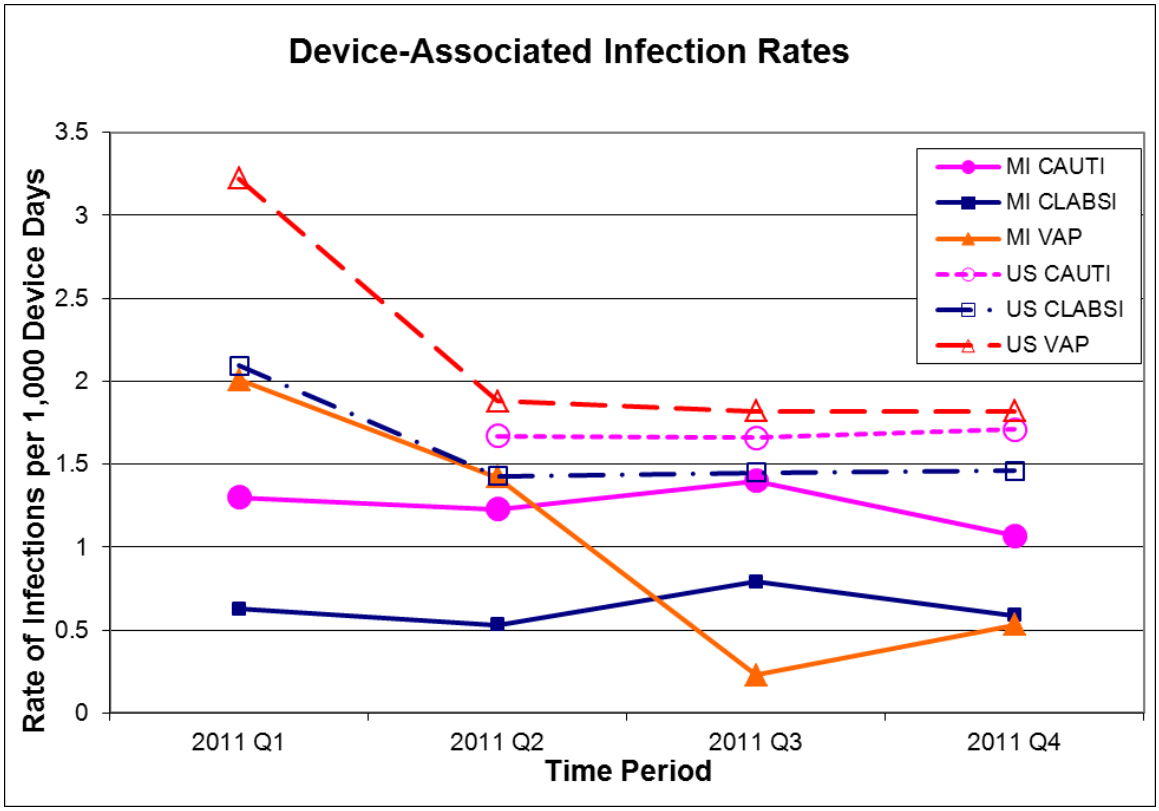
[5]CLABSI: Central Line-Associated Blood Stream Infection

[6]VAP: Ventilator-Associated Pneumonia

From the previous quarter to the present, Michigan CAUTI rates decreased from 1.40 to 1.07 per 1,000 device days. Michigan CLABSI rates decreased from 0.79 to 0.59 per 1,000 device days. VAP rates increased from 0.23 to 0.53 per 1,000 device days. However, none of these rate changes were statistically significantly different than the previous quarter. The Michigan DU ratio remained quite stable from the previous quarter to the present for all three modules.

Figure 4 (below) displays the Michigan and U.S. Device-Associated Infection Rates for all four quarters of 2011.

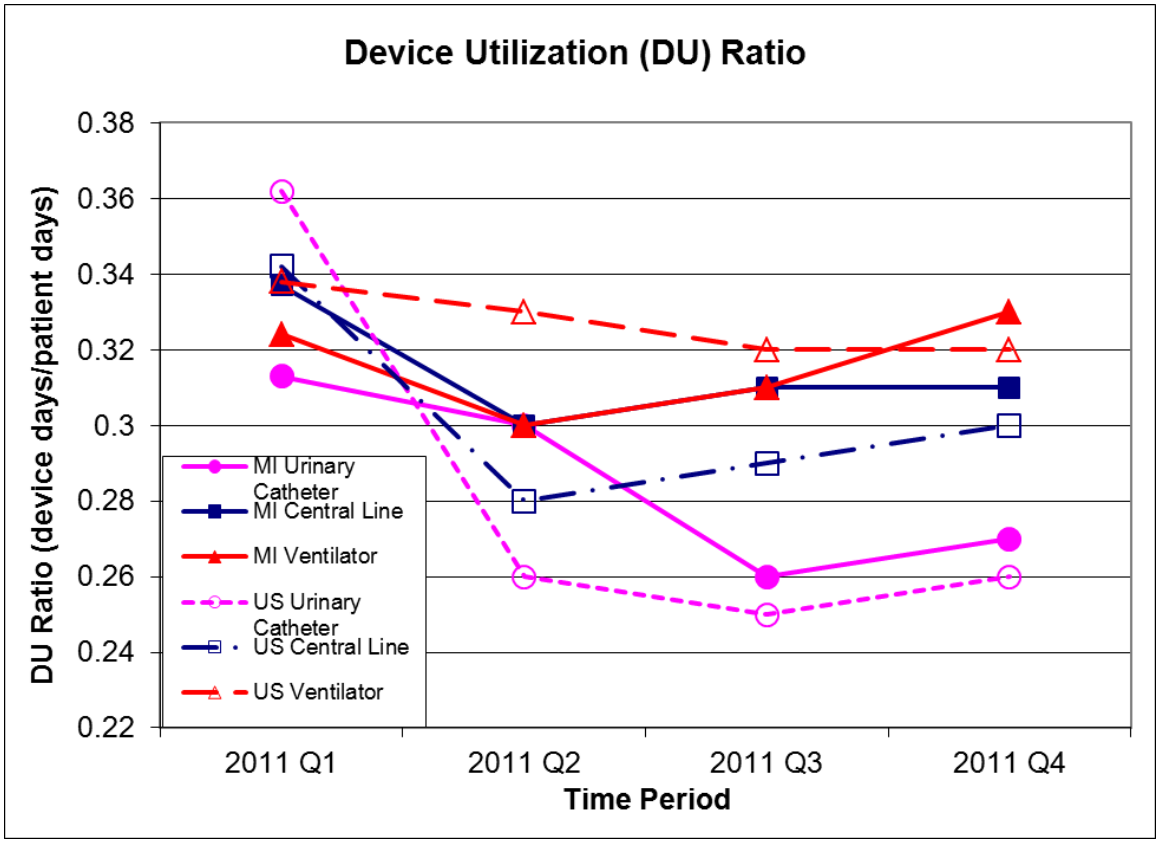
Figure 4.



As displayed in Figure 4, the Michigan infection rates tend to follow the same general distribution as the National NHSN infection rates. However, Michigan rates are all substantially lower than each of their US counterparts

Figure 5 (below) displays the DU ratio for Michigan and the US for the four quarters in 2011.

Figure 5.



Standardized Infection Ratios

Table 6 (below) provides information on the Standardized Infection Ratio (SIR) for CLABSIs and SSIs in the fourth quarter of 2011. An SIR is defined as the ratio of observed events compared to the number of predicted events, while accounting for unit type or procedure. Of the 50 facilities participating in the CLABSI reporting module, 44 provided data to the SHARP Unit. As of March 1, 2012, twenty-one facilities shared SSI data. SSI data were pulled on March 1 to allow hospitals an extra month of time to report infections. Because surgeries are followed for 30 days before reporting events, hospitals were allowed one month after their 30 day follow-up period to report SSIs for the present report.

This quarter's CLABSI SIR demonstrates that Michigan facilities had significantly fewer CLABSIs than predicted based on national averages. An SIR of 0.31 indicates that Michigan had 69% fewer CLABSIs than expected. The SSI SIR (1.06) demonstrates that Michigan had 6% more SSIs than expected. However, this was not statistically significant.

Table 6

Standardized Infection Ratio (SIR)

Type of Infection	Number of Facilities	Procedures Done	Observed[1]	Predicted[2]	SIR[3]	95% CI[4]
CLABSI[5]	44	NA	33	107.61	0.31	(0.21, 0.43)
SSI[6]	21	3,912	66	62.05	1.06	(0.82, 1.36)

☐ Michigan Rate among facilities sharing data with SHARP ☐ Comparative National Rate

[1]Observed: Number of infections (CLABSIs or SSIs) reported during the time frame.

[2]Predicted: The number of CLABSIs predicted based on the type of hospital unit(s) under surveillance, or the number of SSIs predicted for the same number and type of procedures performed based upon national SSI rates by procedure type.

[3]SIR: Standardized Infection Ratio. Ratio of observed events compared to the number of predicted events, accounting for unit type or procedure. An SIR of 1 can be interpreted as having the same number of events that were predicted. An SIR that is between 0 and 1 represents **fewer** events than predicted, while an SIR of greater than 1 represents **more** events than expected.

[4]95% CI: 95% confidence interval around the SIR estimate.

[5]CLABSI: Central Line-Associated Blood Stream Infection

[6]SSI: Surgical Site Infection

Figure 6 (below) displays a CLABSI SIR for each of the quarterly reports for 2011. The center dot on each point represents the calculated SIR for the respective time period. The upper and lower marks represent the upper and lower ends of the 95% Confidence Interval (CI) surrounding the SIR. A 95% CI means that 95% of the time, the true SIR will be located within this interval. If the interval does not surround 1, then the calculated SIR is statistically significantly different from the predicted value. The number 1, or the null value, is indicated by the dashed line.

Figure 6.

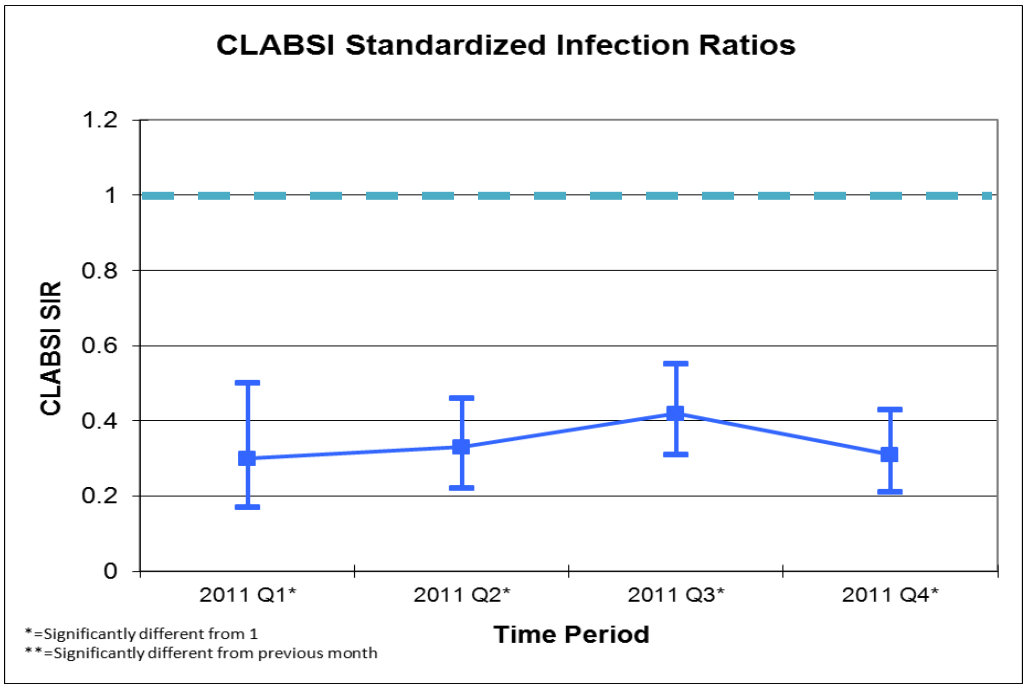
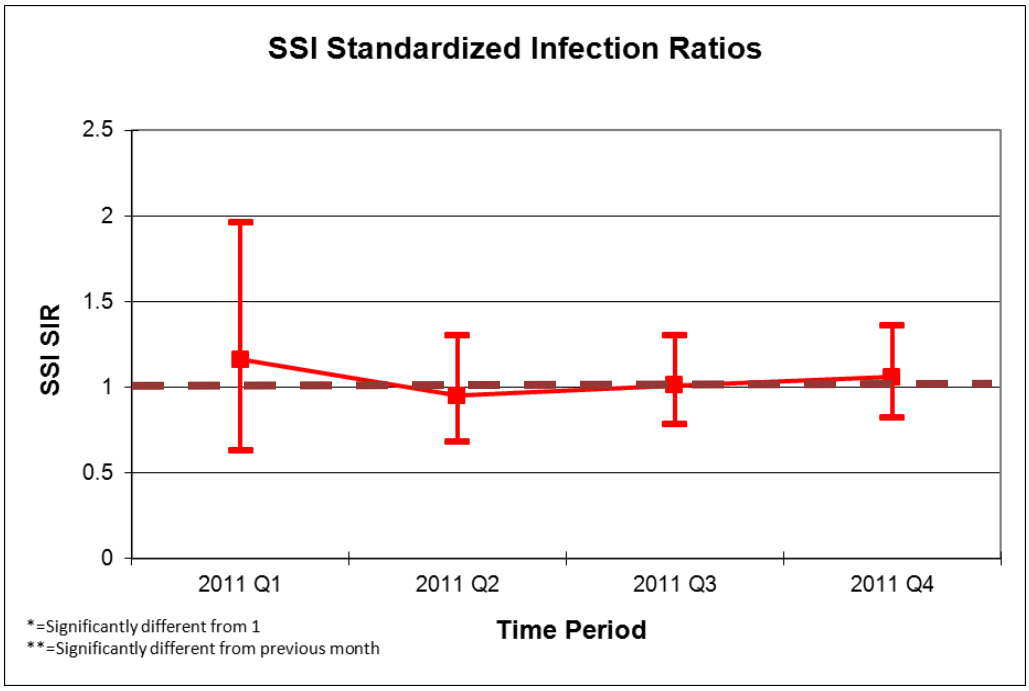


Figure 7 (below) displays the first SSI SIR graph that we have been able to produce. It includes data from each of the first three quarterly reports for 2011. This graph can be interpreted in the same fashion as figure 6.

Figure 7.



Conclusions

Aggregated MRSA and *C. difficile* LabID Events are a bit lower this quarter compared to the previous quarter. Due to the changed Conferred Rights Templates in the second quarter of 2011, there were likely fewer LabID Events reported than actually occurred. This was noted in previous reports, and was corrected for the third quarter report. The reason for fewer LabID Events in the present report cannot be determined with complete certainty, but is most likely due to the data pull date occurring closer to the finish of the quarter than previous reports. Many of the percentage distributions for both MRSA and *C. difficile* were similar to previous quarters.

The MDRO module rates decreased this quarter for MRSA LabID Event, MRSA surveillance, and *C.diff* LabID Event. The rate decrease for MRSA LabID Events was statistically significantly lower. There was a non-significant increase in *C.diff* surveillance rates.

In the Device-Associated Module, both CAUTI and CLABSI rates decreased, and the VAP rate increased slightly. However, these changes were not statistically significant.

This quarter, there appears to be more stability in the number of participating hospitals, as well as the modules that they participate in. Although there aren't many more facilities joining or adding modules, the previous quarter increases have built the number of facilities to a point where we are able to see quite a bit of trend data, as displayed in the graphs in the present report.